

CLAIMS

1. A cleaning solution for removing a polymer comprising:

about 1 to about 10 percent by weight of sulfuric acid;

about 0.5 to about 5 percent by weight of aqueous hydrogen peroxide solution; and

about 85 to about 98.5 percent by weight of hydrogen fluoric acid solution.

2. The cleaning solution of claim 1, wherein the hydrogen fluoric acid solution

includes about 1,000ml of deionized water and about 0.1 to about 2 ml of hydrogen fluoric

acid, wherein the hydrogen fluoric acid has a concentration of about 45 to about 55 percent.

3. A method of cleaning a semiconductor device comprising:

preparing a cleaning solution including about 1 to about 10 percent by weight of sulfuric acid, about 0.5 to about 5 percent by weight of an aqueous hydrogen peroxide solution, and about 85 to about 98.5 percent by weight of a hydrogen fluoric acid solution;

removing polymers attached to a metal wiring formed on a substrate by immersing the substrate in the cleaning solution;

rinsing the substrate to remove the remaining cleaning solution; and

drying the substrate.

4. The method of claim 3, wherein the hydrogen fluoric acid solution comprises

about 1,000 ml of deionized water and about 0.1 to about 2 ml of hydrogen fluoric acid,

wherein the hydrogen fluoric acid has a concentration of about 45 to about 55 percent.

5. The method of claim 3, wherein preparing the cleaning solution comprises

raising a temperature of the cleaning solution to a temperature of about 20 to about 30°C.

6. The method of claim 5, wherein immersing the substrate in the cleaning

solution comprises immersing the substrate in the cleaning solution for about 1 to about 9

minutes.

7. The method of claim 3, wherein the metal wiring corresponds to a gate

electrode that includes tungsten or a bit line that includes tungsten.

8. The method of claim 3, wherein the polymers comprise one selected from the group consisting of organic polymers, metallic polymers, and oxygen-containing polymers.

9. A method of forming a structure for a semiconductor device comprising:

5 providing a substrate with a polysilicon film, a tungsten film, and a nitride film successively formed thereon;

forming a mask pattern on the nitride film;

forming the structure including a nitride film pattern, a tungsten film pattern, and a polysilicon film pattern by dry etching the polysilicon film, the tungsten film, and the nitride
10 film;

removing the mask pattern;

removing polymers attached to a sidewall of the structure by immersing the substrate in a cleaning solution, wherein the cleaning solution comprises about 1 to about 10 percent by weight of sulfuric acid, about 0.5 to about 5 percent by weight of aqueous hydrogen peroxide
15 solution, and about 85 to about 98.5 percent by weight of hydrogen fluoric acid solution, wherein the hydrogen fluoric acid solution comprises deionized water of about 1,000 ml and hydrogen fluoric acid of about 0.1 to about 2 ml, the hydrogen fluoric acid having a concentration of about 50 percent;

rinsing the substrate to remove the cleaning solution remaining on the substrate; and

20 drying the substrate.

10. The method of claim 9, wherein providing a substrate with a polysilicon film, a tungsten film, and a nitride film successively formed thereon comprises forming a barrier layer between the polysilicon film and the tungsten film.

25 11. The method of claim 9, wherein the structure includes a gate electrode or a bit line.

30 12. The method of claim 9, wherein immersing the substrate in a cleaning solution comprises immersing the substrate in a cleaning solution with a temperature of about 20 to about 30°C.

13. The method of claim 12, wherein immersing the substrate in a cleaning solution further comprises immersing the substrate in a cleaning solution for about 1 to about 9 minutes.